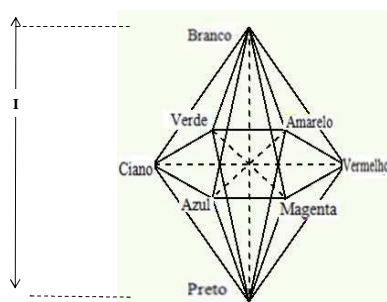


1. Fundamentos de imagens digitais

19/03/2018

- Sistema de Cores HSI
 - Conversão RGB→HSI
- Exercícios

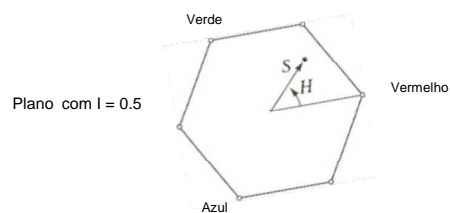
Sistema de cores HSI:



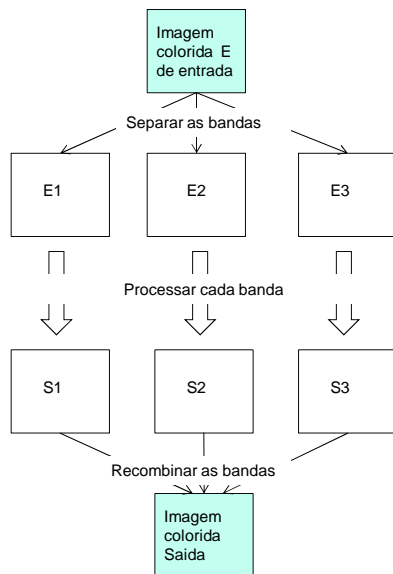
-A Intensidade (I) varia entre 0 (preto) e 1 (branco).

- A Saturação (S) varia entre 0 (localizado no eixo acromático) e 1 (saturado, máxima distância do eixo acromático).

- A Matiz (H) varia entre 0° e 360° (ou entre 0 e 2π).



H	Cor
0°	Vermelho
60°	Amarelo
120°	Verde
180°	Ciano
240°	Azul
320°	Magenta
360°	Vermelho



```
E = imread( 'Entrada.tif' );
[m,n] = size(E)
% conversão uint8 para double:
E = double(E);
```

```
E1 = E(:, :, 1);
E2 = E(:, :, 2);
E3 = E(:, :, 3);
```

```
% Alocando espaço:
H = zeros(m,n);
S = zeros(m,n);
I = zeros(m,n);

%Processamento, gerando
% valores para H, S e I
```

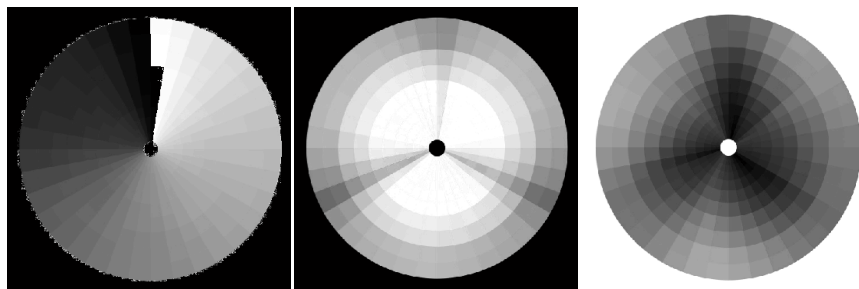
```
H = H/360; S1 = H*255;
S2 = S*255; S3 = I*255;
```

```
Saida(:, :, 1) = S1;
Saida(:, :, 2) = S2;
Saida(:, :, 3) = S3;
```

```
% conversão double para uint8:
Saida = uint8(Saida);
imwrite (Saida, 'Saida.tif')
```

Exercício 1

Dadas as imagens **H.tif**, **S.tif**, **I.tif** em 8 bits, converta cada banda para o intervalo de valores apropriado.



- Na imagem H, pode-se afirmar que ocorre a cor vermelha?
- Represente numa nova imagem os locais onde $H > 330$ e $S > 0.5$

Conversão IHS para RGB

Para valores I, H no intervalo $[0, 1]$; H no intervalo $[0^\circ, 360^\circ]$

-Setor RG: $0^\circ < H \leq 120^\circ$

$$B = I (1 - S)$$

$$R = I \left(1 + \frac{S \cos H}{\cos(60^\circ - H)} \right)$$

$$G = 3I - (R + B)$$

-Setor GB: $120^\circ < H \leq 240^\circ$

$$H = H - 120^\circ$$

$$R = I (1 - S)$$

$$G = I \left(1 + \frac{S \cos H}{\cos(60^\circ - H)} \right)$$

$$B = 3I - (R + G)$$

-Setor BR: $240^\circ < H \leq 360^\circ$

$$H = H - 240^\circ$$

$$G = I (1 - S)$$

$$B = I \left(1 + \frac{S \cos H}{\cos(60^\circ - H)} \right)$$

$$R = 3I - (G + B)$$

Considerar os casos:

I = 0	→	R = ? ; G = ? ; B = ?
I = 1	→	R = ? ; G = ? ; B = ?
S = 0	→	R = ? ; G = ? ; B = ?

GONZALEZ, R.C.; WOODS, R. E. Digital Image Processing. Pearson Education, Inc., 2008.

Conversão IHS-RGB

Para valores I, S no intervalo $[0, 1]$;
H no intervalo $[0^\circ, 360^\circ]$

R, G, B estarão no intervalo $[0, 1]$.

-Setor RG: $0^\circ < H \leq 120^\circ$

$$B = I (1 - S)$$

$$R = I \left(1 + \frac{S \cos H}{\cos(60^\circ - H)} \right)$$

$$G = 3I - (R + B)$$

-Setor GB: $120^\circ < H \leq 240^\circ$

$$H = H - 120^\circ$$

$$R = I (1 - S)$$

$$G = I \left(1 + \frac{S \cos H}{\cos(60^\circ - H)} \right)$$

$$B = 3I - (R + G)$$

-Setor BR: $240^\circ < H \leq 360^\circ$

$$H = H - 240^\circ$$

$$G = I (1 - S)$$

$$B = I \left(1 + \frac{S \cos H}{\cos(60^\circ - H)} \right)$$

$$R = 3I - (G + B)$$

Conversão IHS-RGB

Para valores I, S no intervalo [0, 1];
H no intervalo [0°, 360°]

R, G, B estarão no intervalo [0, 1].

if S == 0

else

-Setor RG: 0° < H ≤ 120°

if H(i,j) >= 0 & H(i,j) <= 120

$$B = I (1 - S)$$

$$R = I \left(1 + \frac{S \cos H}{\cos(60^\circ - H)} \right)$$

$$G = 3I - (R + B)$$

-Setor GB: 120° < H ≤ 240°

if H(i,j) > 120 & H(i,j) <= 240

$$H = H - 120^\circ$$

$$R = I (1 - S)$$

$$G = I \left(1 + \frac{S \cos H}{\cos(60^\circ - H)} \right)$$

$$B = 3I - (R + G)$$

-Setor BR: 240° < H ≤ 360°

if H(i,j) > 240 & H(i,j) <= 360

$$H = H - 240^\circ$$

$$G = I (1 - S)$$

$$B = I \left(1 + \frac{S \cos H}{\cos(60^\circ - H)} \right)$$

$$R = 3I - (G + B)$$

end

end

for i = 1:m

for j = 1:n

if S(i,j) == 0

b(i,j) = I(i,j); g(i,j) = I(i,j); r(i,j) = I(i,j);

else

if H(i,j) >= 0 & H(i,j) <= 120

b(i,j) = I(i,j) * (1 - S(i,j));

r(i,j) = I(i,j) * (1 + (S(i,j) * cosd(H(i,j)) / cosd(60 - H(i,j))));

g(i,j) = 3*I(i,j) - (b(i,j) + r(i,j)) ;

end

if H(i,j) > 120 & H(i,j) <= 240

H(i,j) = H(i,j) - 120;

r(i,j) = I(i,j) * (1 - S(i,j));

g(i,j) = I(i,j) * (1 + (S(i,j) * cosd(H(i,j)) / cosd(60 - H(i,j))));

b(i,j) = 3*I(i,j) - (r(i,j) + g(i,j)) ;

end

if H(i,j) > 240 & H(i,j) <= 360

H(i,j) = H(i,j) - 240;

g(i,j) = I(i,j) * (1 - S(i,j));

b(i,j) = I(i,j) * (1 + (S(i,j) * cosd(H(i,j)) / cosd(60 - H(i,j))));

r(i,j) = 3*I(i,j) - (g(i,j) + b(i,j)) ;

end

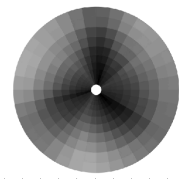
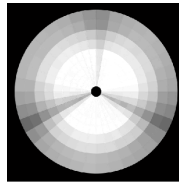
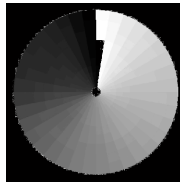
end

end

end

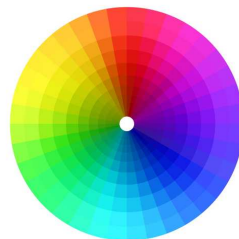
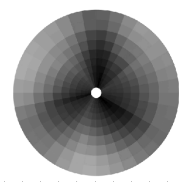
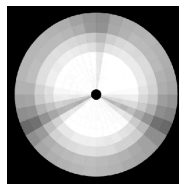
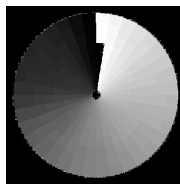
Exercício 2

Dadas as imagens H.tif , S.tif, I.tif , converter do sistema de cores HSI para o sistema RGB, gerando a imagem colorida 'RodaDasCores.tif'.

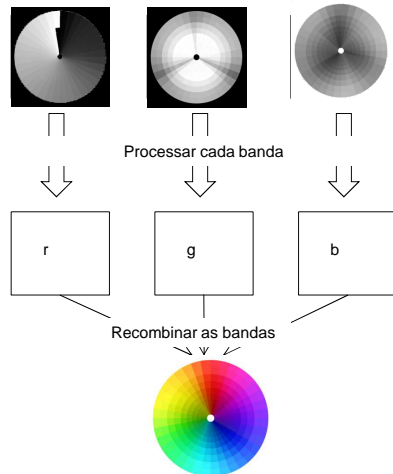


Exercício 2

Dadas as imagens H.tif , S.tif, I.tif , converter do sistema de cores HSI para o sistema RGB, gerando a imagem colorida 'RodaDasCores.tif'.



Resolução do exercício 2:



```
H=imread('H.tif');
% Idem para S e I
```

```
[m,n] = size(H);
```

```
H = double(H);
% idem para S e I
```

```
% converter:
% 0 <= H <=360; 0<= S, I <=1;
```

```
% Alocando espaço:
```

```
r = zeros(m,n);
g = zeros(m,n);
b = zeros(m,n);
```

```
%Processamento, gerando
% r, g e b
```

```
Sai(:,1) = round(255*r(:,1));
Sai(:,2) = round(255*g(:,1));
Sai(:,3) = round(255*b(:,1));
```

```
% conversão double para uint8:
Sai = uint8(Sai);
imwrite(Sai, 'RodaDasCores.tif')
% para MATLAB: imwrite(Sai, 'RodaDasCores.tif',
% 'compress', 'none')
```

Exercício 3: Converta a imagem “roda_das_cores.tif” para o sistema de cores HSI e salve a imagem resultante no formato tif.

